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Effects of biochar amendment on greenhouse gas emissions, net ecosystem carbon budget and properties of an acidic soil under intensive vegetable production

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Abstract

© 2015 British Society of Soil Science. Biochar addition to soils has been frequently proposed as a means to increase soil fertility and carbon (C) sequestration. However, the effect of biochar addition on greenhouse gas emissions from intensively managed soils under vegetable production at the field scale is poorly understood. The effects of wheat straw biochar amendment with mineral fertilizer or an enhanced-efficiency fertilizer (mixture of urea and nitrapyrin) on N2O efflux and the net ecosystem C budget were investigated for an acidic soil in southeast China over a 1-yr period. Biochar addition did not affect the annual N2O emissions (26-28 kg N/ha), but reduced seasonal N2O emissions during the cold period. Biochar increased soil organic C and CO2 efflux on average by 61 and 19%, respectively. Biochar addition greatly increased C gain in the acidic soil (average 11.1 Mg C/ha) compared with treatments without biochar addition (average -2.2 Mg C/ha). Biochar amendment did not increase yield-scaled N2O emissions after application of mineral fertilizer, but it decreased yield-scaled N2O by 15% after nitrapyrin addition. Our results suggest that biochar amendment of acidic soil under intensive vegetable cultivation contributes to soil C sequestration, but has only small effects on both plant growth and greenhouse gas emissions.

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Keywords

Biochar, Nitrification inhibitor, Soil fertility, Soil heterotrophic respiration